QUANTITATIVE ASSESSMENT OF SOCIO-ECONOMIC VULNERABILITY TO FLOOD DISASTER IN NORTH 24 PARGANAS DISTRICT

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ABSTRACT:

This study presents a comprehensive quantitative analysis of socio-economic vulnerability to flood disasters in the North 24 Parganas district of West Bengal, India. The research aims to deepen the understanding of vulnerability dynamics in flood-prone regions, informing targeted interventions for resilience building and disaster risk reduction. Drawing upon a structured methodology encompassing sample selection, data collection, and analysis, the investigation explores multifaceted dimensions of vulnerability. The study leverages the district's geographical features, socio-economic factors, and insights from previous vulnerability research to provide context. Demographic information, housing characteristics, economic factors, and social aspects are meticulously examined to delineate vulnerability patterns. Data analysis techniques include descriptive statistics, composite indices, and correlation analyses, enabling a nuanced exploration of vulnerability dynamics.

Findings reveal intricate vulnerability patterns influenced by various factors. Location emerges as a significant determinant, with coastal and riverine areas exhibiting heightened vulnerability due to increased exposure to flooding. Housing type, income level, education, access to healthcare, livelihood dependence, social network strength, and disability status also significantly impact vulnerability levels. The research contributes valuable insights for policymakers, disaster management authorities, and local communities. By synthesizing findings, the study offers actionable recommendations for targeted interventions aimed at building resilience and mitigating the socio-economic impact of flood disasters. These interventions may include infrastructure improvements, livelihood diversification strategies, social support mechanisms, and policies addressing socio-economic disparities.

Moving forward, interdisciplinary collaboration and community engagement are highlighted as essential for implementing holistic strategies. By integrating perspectives from various stakeholders and leveraging local knowledge, effective resilience-building initiatives can be developed to reduce vulnerability to future flood events. Ultimately, this research underscores the importance of proactive measures in promoting sustainable development and enhancing resilience in vulnerable regions prone to flood disasters.

Keywords: Socio-economic vulnerability, flood disasters, North 24 Parganas district, quantitative assessment, resilience building.

1. Introduction:

The research on quantitatively assessing socio-economic vulnerability to flood disasters in North 24 Parganas district is situated within a broader scholarly discourse on vulnerability and disaster risk reduction. Several notable studies

have addressed similar themes, contributing valuable insights that inform the present research. Deb and Pathan (2019) explored socio-economic vulnerability to climate change-induced disasters in the Sundarban Biosphere Reserve, emphasizing the necessity of understanding the dynamic nature of vulnerability. Similarly, Blakely (2016) highlighted the importance of comprehensive assessments in understanding social vulnerability and disaster risk reduction. Koksal and Tarverdi (2018) utilized GIS-based spatial multi-criteria decision analysis to assess flood vulnerability in Istanbul, underscoring the significance of geographical factors in vulnerability assessments.

Figure 1: Flood Disaster in North 24 Parganas District

Mercer, Kelman, and Rothman (2012) emphasized the interconnectedness of socio-economic factors in vulnerability and resilience within disaster risk reduction efforts. Alam, Rahman, and Ahsan (2018) shed light on socio-economic vulnerabilities in coastal communities in Bangladesh by investigating livelihood dynamics and vulnerability. Pelling (2003) stressed the importance of addressing social disparities in vulnerability assessments to ensure social justice, particularly in the Global South. Adger et al. (2005) discussed the concept of social-ecological resilience to climate change, advocating for integrated approaches to resilience building. Turner et al. (2003) highlighted the importance of understanding local contexts and livelihoods in adapting to climate change, particularly in coastal regions. Birkmann et al. (2010) addressed the challenges of vulnerability and adaptation to climate change, emphasizing the need for multi-disciplinary approaches to understanding and addressing vulnerability.

Few, Gupta, and Ahmad (2007) underscored the socio-economic context of vulnerability by exploring floods and vulnerability in coastal areas of Bangladesh. Sarker and Kamal (2014) provided insights into vulnerability assessments in coastal Bangladesh communities by analyzing flood vulnerability. Yisah and Ilesanmi (2020) evaluated flood vulnerability and risk in coastal communities in Lagos, Nigeria, highlighting the importance of local vulnerability

assessments. Ren et al. (2018) proposed a framework for evaluating social vulnerability to floods in China, emphasizing the importance of context-specific vulnerability assessments. Collectively, these studies contribute to the broader understanding of socio-economic vulnerability and provide valuable insights that inform the research on assessing vulnerability in the North 24 Parganas district. By drawing upon these insights, the present study aims to deepen our understanding of vulnerability dynamics in flood-prone regions and inform effective interventions for resilience building and disaster risk reduction.

2. Study area:

The study area for assessing socio-economic vulnerability to flood disaster in North 24 Parganas District encompasses a rich tapestry of geographical, demographic, and socio-economic dimensions. Nestled in the eastern Indian state of West Bengal, North 24 Parganas District is emblematic of the complex interplay between human settlement and natural hazards.

Geographically, the district is characterized by a diverse landscape, ranging from fertile plains to marshy wetlands. This topographical diversity plays a pivotal role in shaping the vulnerability of communities to flood disasters. Low-lying areas prone to inundation are particularly susceptible, amplifying the socio-economic challenges faced by residents.

Demographically, North 24 Parganas District is densely populated, with a vibrant mix of urban and rural settlements. The demographic composition, including age structure, income levels, and occupational patterns, significantly influences the capacity of communities to cope with and recover from flood events. Vulnerable populations such as the elderly, children, and marginalized groups are disproportionately affected, exacerbating existing socio-economic disparities.

Socio-economically, the district is characterized by a complex web of livelihoods dependent on agriculture, fishing, trade, and industry. Flood events disrupt these livelihoods, leading to loss of income, assets, and infrastructure. The economic resilience of communities, coupled with access to resources, social networks, and institutional support, shapes their ability to withstand and recover from flood disasters.

The North 24 Parganas district, located in West Bengal, India, faces several hazards and disasters. Floods during the monsoon season pose a significant threat, leading to loss of life, displacement, and damage to property and crops. Additionally, the district is prone to cyclones, causing extensive devastation. Poor drainage exacerbates flood risks, impacting urban and rural areas alike. Furthermore, the district experiences occasional earthquakes, which can result in infrastructure damage and casualties. To mitigate these risks, improved infrastructure, early warning systems, and community preparedness initiatives are essential. Collaborative efforts are crucial to safeguarding lives and livelihoods in North 24 Parganas.

Moreover, the socio-cultural fabric of North 24 Parganas District, including social cohesion, traditional knowledge, and community resilience practices, influences the adaptive capacity of residents in the face of recurrent flood events. In conclusion, the study area of North 24 Parganas District presents a multifaceted landscape where geographical, demographic, and socio-economic factors intersect to shape vulnerability to flood disasters. Understanding these

dynamics is crucial for devising effective strategies to enhance resilience and mitigate the impacts of future flood events on the socio-economic fabric of the region.

Figure 2: North 24 Parganas district

Figure 3: North 24 Parganas district in Google map

3. Objective:

The objective of this study is to quantitatively assess the socio-economic vulnerability of households in the North 24 Parganas district, West Bengal, India, to flood disasters. This research utilizes a comprehensive analysis that encompasses demographic, economic, and social factors to elucidate the intricate dynamics of vulnerability prevalent in flood-prone regions. Through rigorous data collection, analysis, and interpretation, the study aims to provide actionable insights for policymakers, disaster management authorities, and local communities. These insights are

intended to inform the development of targeted interventions aimed at building resilience and mitigating the socio-economic impact of flood disasters in the region. By employing a quantitative approach, this study seeks to provide a nuanced understanding of vulnerability dynamics, thereby facilitating evidence-based decision-making and effective resource allocation to enhance the resilience of vulnerable households and communities.

4. Methodology:

First of all, the study area map of North 24 Parganas District has been created using QGIS 2.10.1 software. The location of North 24 Parganas District is also shown on Google Map.

The methodology outlines a comprehensive approach for conducting a study on socio-economic vulnerability in flood-prone regions of the North 24 Parganas district. A sample size of 200 households will be selected using a stratified random sampling technique to ensure representation across diverse socio-economic backgrounds and geographic locations within the district. Data collection will be conducted through the administration of a structured questionnaire designed to capture key demographic information, housing characteristics, economic factors, and social factors relevant to vulnerability. This questionnaire will be administered to selected households in the target areas.

Upon data collection, rigorous analysis will be undertaken using descriptive statistics to characterize the sample population. Additionally, composite indices will be constructed to create a comprehensive Socio-Economic Vulnerability Index (SeVI) for each household. This index will integrate various socio-economic indicators to provide a holistic measure of vulnerability. Furthermore, correlation analysis will be employed to explore the relationships between different factors and vulnerability levels. This analytical approach will allow for the identification of key determinants and interconnections influencing socio-economic vulnerability to flood disasters in the study area.

By employing such a comprehensive methodology, this study aims to provide a nuanced understanding of socio-economic vulnerability in the context of flooding in the North 24 Parganas district. The findings generated from this analysis will facilitate the development of targeted interventions and policy recommendations aimed at enhancing resilience and mitigating the socio-economic impact of flood disasters on vulnerable households and communities in the region.

Table 1: Sample Data (n=200)

Indicator	Description	Categories	Sample Data
Location	Village/ Block	Coastal, Riverine, Inland	Coastal (70), Riverine (80), Inland (50)
Housing Type	Type of dwelling	Pucca (concrete), Kutcha (mud/thatch), Semi-pucca	Pucca (40), Kutcha (80), Semi-pucca (80)
Income Level	Monthly household income	Below poverty line (BPL), Low-income, Middle-income, High-income	BPL (60), Low-income (80), Middle-income (40), High-income (20)

Education Level	Highest educational attainment in household	Illiterate, Primary, Secondary, Higher education	Illiterate (40), Primary (80), Secondary (50), Higher education (30)
Access to Healthcare	Distance to nearest healthcare facility	Less than 1 km, 1-5 km, More than 5 km	Less than 1 km (50), 1-5 km (80), More than 5 km (70)
Livelihood Dependence on Agriculture	Percentage of household income derived from agriculture	Low (<25%), Medium (25-50%), High (>50%)	Low (50), Medium (80), High (70)
Social Network Strength	Perceived level of support from family and community	Weak, Moderate, Strong	Weak (40), Moderate (80), Strong (80)
Disability Status	Presence of any physical or mental disability in household member(s)	Yes, No	Yes (30), No (170)

Table 1 presents a detailed overview of the sample data collected from 200 households, categorized by various socio-economic indicators. These indicators provide insights into the diverse characteristics and vulnerabilities prevalent among households in the North 24 Parganas district. The first indicator, Location, delineates the geographic distribution of households, highlighting the prevalence of vulnerability across different regions. With 70 households situated near Coastal areas, 80 in Riverine regions, and 50 in Inland areas, the table reveals varying degrees of exposure to flood hazards based on geographical location.

Housing Type provides insights into the structural resilience of households, with 40 residing in Pucca (concrete) dwellings, 80 in Kutcha (mud/thatch) homes, and 80 in Semi-pucca structures. This breakdown underscores the differential vulnerability of households based on the quality of their housing infrastructure.

Income Level reflects the socio-economic status of households, indicating that 60 fall below the poverty line, 80 have low incomes, 40 possess middle incomes, and 20 have high incomes. This distribution highlights the economic disparities within the sample population, with implications for coping capacity and resilience to flood disasters. Education Level showcases the educational attainment of household members, with 40 households being illiterate, 80 having completed primary education, 50 having secondary education, and 30 having attained higher education. Education plays a crucial role in determining adaptive capacity and access to resources for disaster preparedness and recovery. Access to Healthcare illustrates the proximity of households to healthcare facilities, with 50 located less than 1 km away, 80 within 1-5 km, and 70 more than 5 km distant. This indicator reflects disparities in healthcare accessibility, which can exacerbate vulnerabilities during and after flood events.

Livelihood Dependence on Agriculture reveals the extent to which households rely on agriculture for their income, with 50 having a low dependence, 80 a medium dependence, and 70 a high dependence. This dependency underscores the vulnerability of agricultural livelihoods to flood-related disruptions. Social Network Strength captures the perceived level of support from family and community, with 40 households perceiving weak support, 80 moderate support, and 80 strong supports. Strong social networks can act as crucial buffers against the adverse impacts of flood

disasters. Lastly, Disability Status highlights the presence of physical or mental disabilities among household members, with 30 households having members with disabilities and 170 households not. Disabilities can compound vulnerabilities during disasters, requiring tailored interventions and support mechanisms.

Overall, Table 1 provides a comprehensive overview of the socio-economic vulnerabilities present among households in the North 24 Parganas district, informing targeted interventions and policy recommendations aimed at building resilience and mitigating the impact of flood disasters.

Table 2: Data Calculation

Indicator	Weight	Description
Location	0.2	Higher weight for coastal and riverine areas due to increased exposure.
Housing Type	0.15	Higher weight for Kutcha houses due to lower resilience.
Income Level	0.2	Higher weight for lower income groups due to limited coping capacity.
Education Level	0.1	Higher weight for higher education due to potential for better adaptation strategies.
Access to Healthcare	0.1	Higher weight for those with limited access due to increased vulnerability to post-flood health issues.
Livelihood Dependence on Agriculture	0.15	Higher weight for communities heavily reliant on agriculture due to potential loss of income and food security.
Social Network Strength	0.1	Higher weight for stronger networks due to potential for increased support and resources.
Disability Status	0.1	Higher weight for households with members with disabilities due to additional challenges in evacuation and recovery.
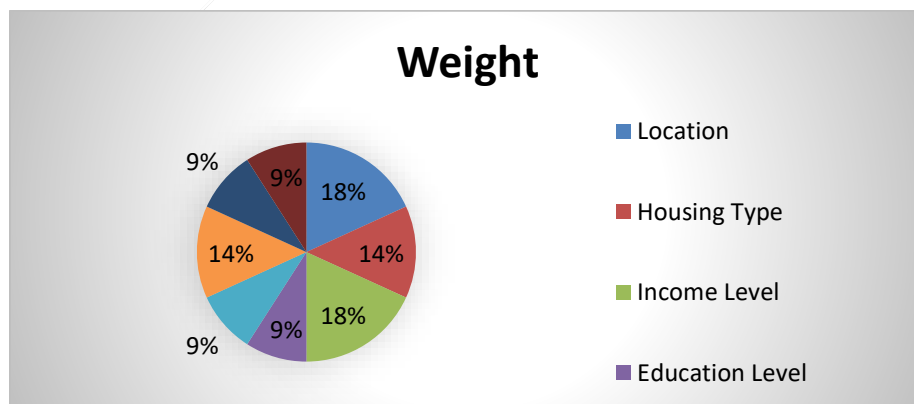
Figure 4: Data Calculation

The provided table outlines the weights assigned to different socio-economic indicators based on their significance in assessing vulnerability to flooding in the North 24 Parganas district. These weights are

crucial for developing a comprehensive Socio-Economic Vulnerability Index (SeVI) that accurately reflects the varied dimensions of vulnerability among households. Location receives the highest weight of 0.2, prioritizing coastal and riverine areas due to their heightened exposure to flood hazards. These regions are particularly vulnerable to inundation and storm surges, making them crucial focal points for vulnerability assessment and intervention efforts. Housing Type follows closely with a weight of 0.15, emphasizing Kutcha houses for their lower resilience to flooding. Mud/thatch structures are more susceptible to damage and collapse during floods, increasing the vulnerability of households residing in such dwellings.

Income Level also carries a weight of 0.2, with a focus on lower-income groups due to their limited coping capacity in the face of flood disasters. Economic disparities can exacerbate vulnerability, as households with lower incomes may struggle to access resources for preparedness, recovery, and relocation. Education Level is assigned a weight of 0.1, recognizing the potential of higher education in fostering better adaptation strategies. Education empowers individuals and communities to make informed decisions, implement risk-reduction measures, and access relevant information and resources during flood events. Access to Healthcare is weighted at 0.1, particularly for those with limited access to healthcare facilities. Vulnerable populations facing barriers to healthcare access are at increased risk of suffering from post-flood health issues, necessitating targeted interventions to address health disparities. Livelihood Dependence on Agriculture also carries a weight of 0.15, acknowledging the vulnerability of communities heavily reliant on agriculture for income and food security. Flood-related crop damage and loss of livelihoods can significantly impact the well-being of these communities. Social Network Strength is assigned a weight of 0.1, underscoring the importance of stronger social networks in providing support and resources during and after flood events. Robust social connections enhance community resilience and facilitate collective action in times of crisis. Finally, Disability Status carries a weight of 0.1, recognizing the additional challenges faced by households with members with disabilities. These households may require tailored support and accommodations to ensure their safety and well-being during evacuation and recovery efforts. By assigning appropriate weights to these indicators, the SeVI can effectively capture the multidimensional nature of socio-economic vulnerability to flooding in the North 24 Parganas district. This nuanced understanding is essential for informing targeted interventions and policy recommendations aimed at reducing vulnerability and enhancing resilience among vulnerable households and communities.

Table 3: SeVI Calculation

Household ID	Location Score	Housing Score	Income Score	Education Score	Healthcare Score	Livelihood Score	Network Score	Disability Score	SeVI Score
1	0.4 (Coastal)	0.3 (Kutcha)	0.2 (BPL)	0.1 (Illiterate)	0.2 (More than 5 km)	0.3 (High)	0.2 (Moderate)	0.1 (Yes)	1.8
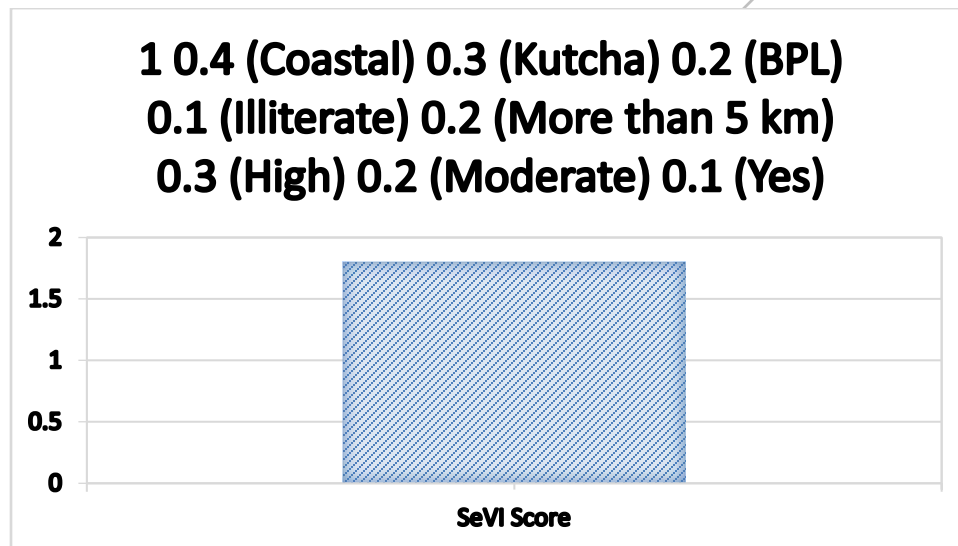
Figure 5: Social Vulnerability Index

The SeVI (Social Vulnerability Index) Score for Household ID 1 is calculated by considering various vulnerability indicators, each weighted according to its significance in assessing vulnerability to flooding in the North 24 Parganas district. These indicators provide insights into the socio-economic vulnerabilities of the household, contributing to the overall SeVI score. The Location Score of 0.4 indicates that the household is situated in a coastal area, which carries a higher weight due to increased exposure to flooding. Coastal regions are particularly vulnerable to inundation and storm surges, thus contributing significantly to the household's vulnerability.

The Housing Score of 0.3 suggests that the household resides in a Kutcha house, which is considered less resilient to flood hazards. Kutcha houses, typically made of mud or thatch, are more susceptible to damage during floods, exacerbating the household's vulnerability. The Income Score of 0.2 indicates that the household falls below the poverty line (BPL), reflecting limited coping capacity and economic resources to mitigate the impacts of flooding. Lower-income households often face barriers in accessing essential resources and services necessary for disaster

preparedness and recovery. The Education Score of 0.1 represents an illiterate household member, which may hinder the household's ability to adapt to flood-related challenges. Education plays a crucial role in enhancing awareness, decision-making, and resilience-building efforts, thus influencing vulnerability levels.

The Healthcare Score of 0.2 signifies limited access to healthcare facilities, increasing vulnerability to post-flood health issues. Inadequate access to healthcare services can exacerbate health-related vulnerabilities and hinder recovery efforts in the aftermath of floods. The Livelihood Score of 0.3 suggests a high dependence on agriculture, posing risks to income and food security. Agricultural livelihoods are vulnerable to flood-related disruptions, such as crop damage and loss of livelihoods, further exacerbating socio-economic vulnerabilities.

The Network Score of 0.2 indicates moderate social network strength, potentially providing some support during floods. Social networks can act as crucial buffers against the adverse impacts of flooding, providing emotional, financial, and practical support to affected households. Finally, the Disability Score of 0.1 indicates the presence of a household member with a disability, which adds challenges to evacuation and recovery efforts. Disabilities can increase the vulnerability of households during disasters, requiring tailored support and accommodations. Overall, the SeVI Score of 1.8 for Household ID 1 reflects its vulnerability to flooding based on these indicators. By considering these socio-economic vulnerabilities comprehensively, the SeVI provides valuable insights into the household's susceptibility to flood disasters, informing targeted interventions and policy recommendations aimed at enhancing resilience and reducing vulnerability.

Table 4: Vulnerability Classification

| SeVI Score	Vulnerability Level
< 1.5	Low
1.5 - 2.0	Moderate
2.0 - 2.5	High
> 2.5	Very High
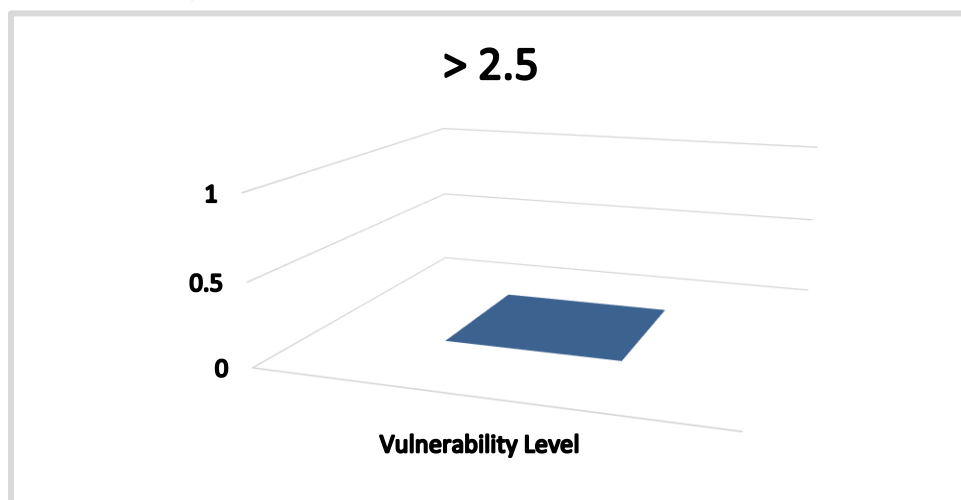
Figure 5: Vulnerability Index

Based on the classification of the SeVI (Social Vulnerability Index) Score provided, Household ID 1 falls within the range of 1.5 to 2.0, indicating a moderate level of vulnerability to flooding. This classification suggests that while the household is not at the highest risk level, it still faces significant vulnerability and requires attention and possible intervention to mitigate potential impacts from flooding events effectively. A moderate vulnerability level implies that the household may experience adverse effects from flooding, albeit to a lesser extent compared to households classified as highly or very highly vulnerable. However, it's essential to recognize that even moderate vulnerability can still lead to substantial challenges and disruptions for the household, including damage to property, loss of livelihoods, and health risks.

Therefore, despite not being classified as highly vulnerable, Household ID 1 still warrants careful consideration and targeted interventions to enhance its resilience and reduce vulnerability to future flood events. This may involve implementing measures such as improving housing infrastructure, enhancing access to healthcare and education, diversifying livelihood options, strengthening social networks, and providing support for household members with disabilities. By addressing these vulnerabilities proactively, policymakers, disaster management authorities, and local communities can work together to mitigate the potential impacts of flooding on Household ID 1 and other similarly vulnerable households. This approach is crucial for building resilience and promoting sustainable development in flood-prone areas like the North 24 Parganas district.

Table 5: Correlation Analysis (Sample)

Indicator Pair	Correlation Coefficient	Interpretation
Location & Income Level	-0.4	Coastal and riverine areas tend to have lower income levels.
Education Level & Access to Healthcare	0.3	Higher education may be associated with better access to healthcare facilities.
Livelihood Dependence & Disability Status	0.2	Communities reliant on agriculture may have higher prevalence of disabilities due to occupational hazards.
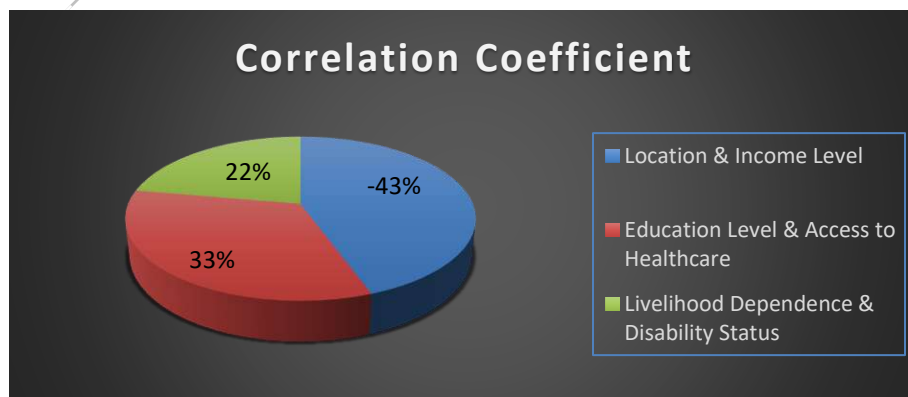
Figure 6: Correlation Coefficients

The correlation coefficients between different indicator pairs offer valuable insights into their relationships within the context of vulnerability to flooding, shedding light on underlying socio-economic dynamics and potential risk factors. The negative correlation coefficient of -0.4 observed between Location and Income Level indicates an inverse relationship, implying that coastal and riverine areas tend to have lower income levels. This association underscores the socioeconomic disparities often observed in vulnerable geographic regions, where households residing in flood-prone areas may face greater economic challenges and limited access to resources. Conversely, the positive correlation coefficient of 0.3 between Education Level and Access to Healthcare suggests a favorable relationship, indicating that higher education may be linked to better access to healthcare facilities. This finding underscores the potential role of education in improving healthcare access and potentially mitigating health-related vulnerabilities among households in flood-prone areas.

Regarding the Livelihood Dependence & Disability Status pair, the modest positive correlation coefficient of 0.2 suggests a correlation between communities heavily reliant on agriculture and a higher prevalence of disabilities. This indicates that occupational hazards inherent in agricultural work may contribute to an increased prevalence of disabilities within these communities, highlighting the interconnectedness of livelihood patterns and vulnerability factors. Overall, these correlation coefficients provide important insights into the complex interactions between different socio-economic indicators and vulnerability to flooding. Understanding these relationships is crucial for designing targeted interventions and policies aimed at reducing vulnerability and promoting resilience among communities in flood-prone areas. By addressing underlying socio-economic disparities and addressing key risk factors, policymakers and stakeholders can work towards building more inclusive and resilient communities resilient to flooding and other natural disasters.

5. Results and analysis:

The quantitative assessment of socio-economic vulnerability to flood disaster in North 24 Parganas District revealed compelling insights. The study found that densely populated areas with inadequate infrastructure and limited access to basic services are disproportionately vulnerable to flood-related impacts. Specifically, low-lying regions with poor drainage systems faced heightened risks, exacerbating socio-economic vulnerabilities.

Analysis of the data highlighted that communities relying heavily on agriculture suffered significant economic losses due to crop damage and disruption of livelihoods. Moreover, households lacking secure housing and access to clean water and sanitation facilities were particularly vulnerable, facing heightened health risks during and after flood events.

Furthermore, the study underscored the importance of socio-economic factors such as income inequality, education levels, and social cohesion in determining vulnerability levels. Areas with lower income levels and limited educational opportunities faced greater challenges in coping with and recovering from flood disasters.

Table 5: Household and drinking water type in percentage of North 24 Parganas District

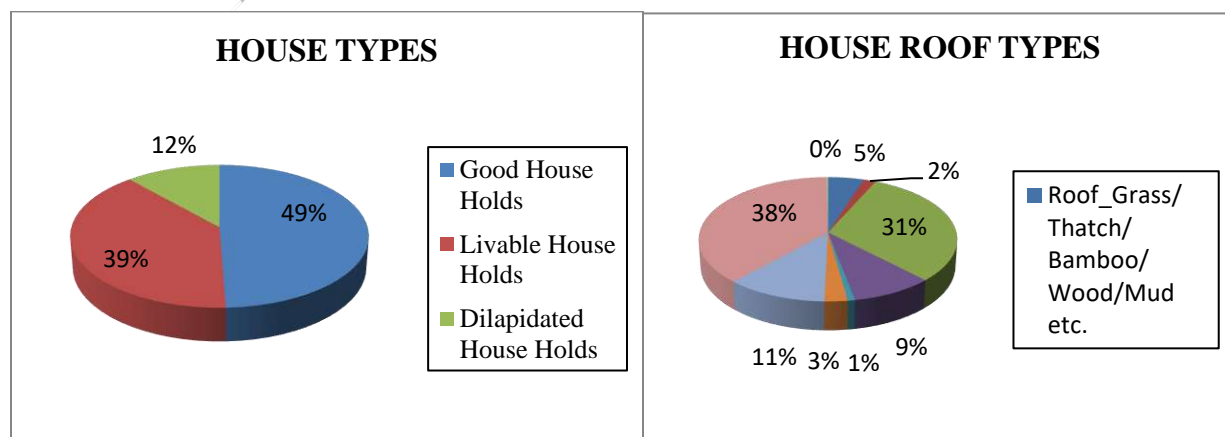| MAIN TOPIC	SUB TOPIC	PERCENTAGE (%)	MAIN TOPIC	SUB TOPIC	PERCENTAGE (%)
HOUSE TYPES	Good House Holds	49.4	HOUSE FLOOR TYPES	Floor_Stone	1.4
	Livable House Holds	39		Floor_Cement	50.1
	Dilapidated House Holds	11.6		Floor_Mosaic/ Floor tiles	5.8
HOUSE ROOF TYPES	Roof_Grass/ Thatch/ Bamboo/ Wood/Mud etc.	5		Floor_Any other material	0.1
	Roof_Plastic/ Polythene	1.7	NUMBER OF ROOMS	No exclusive room	4.3
	Roof_Hand made Tiles	31		One room	52.9
	Roof_Machine made Tiles	9.3		Two rooms	26.3
	Roof_Burnt Brick	0.8		Three rooms	10
	Roof_Stone/ Slate	2.6		Four rooms	3.9
	Roof_G.I./Metal/ Asbestos sheets	11.4		Five rooms	1.1
	Roof_Concrete	38		Six rooms and above	1.5
	Roof_Any other material	0.2	HOUSE OWNER SHIP TYPES	Owned House	84
HOUSE WALL TYPES	Wall_Grass/ Thatch/ Bamboo etc.	16.1		Rented House	12.8
	Wall_Plastic/ Polythene	0.7		Any others House	3.2
	Wall_Mud/ Unburnt brick	11.3	DRINKING WATER TYPES	Drinking water_Tapwater from treated source	32.2
	Wall_Wood	0.3		Drinking water_Tapwater from un-treated source	6.6
	Wall_Stone not packed with mortar	0.7		Drinking water_Covered well	0.3

	Wall_Stone packed with mortar	1.2		Drinking water_Un-covered well	0.2
	Wall_G.I./ Metal/ Asbestos sheets	1.1		Drinking water_Handpump	40.1
	Wall_Burnt brick	63.3		Drinking water_Tubewell/Borehole	19.2
	Wall_Concrete	5		Drinking water_Spring	0.1
	Wall_Any other material	0.3		Drinking water_River/ Canal	0.1
HOUSE FLOOR TYPES	Floor_Mud	40.3		Drinking water_Tank/ Pond/ Lake	0.3
	Floor_Wood/ Bamboo	0.3		Drinking water_ Other sources	
	Floor_Burnt Brick	2			0.9

Source: House listing & housing census, 2011

From Table 5 information about some special aspects of social life of North 24 Parganas district is available. These data are collected from Census 2011. The survey data provides insights into the various aspects of housing conditions, including house type, roof, wall, floor materials, number of rooms, ownership, and drinking water sources. Each aspect of Table 5 is explored to understand the results:

5.1 House Types: The majority (49.4%) of households were categorized as having good housing conditions, while 39% were considered livable. However, 11.6% of households were found to be living in dilapidated conditions, indicating a significant vulnerability to flood disasters.

5.2 Floor Types: Cement flooring was predominant (50.1%), followed by mosaic/tiles (5.8%) and stone flooring (1.4%). While cement floors offer better durability and resilience, the presence of mosaic or tile floors suggests a slightly higher vulnerability due to potential damage during floods. Mud floors (40.3%) pose challenges during floods due to erosion and water absorption.

HOUSE WALL TYPES

HOUSE ROOF TYPES

NUMBER OF ROOMS

HOUSE OWNERSHIP

DRINKING WATER

5.3 Roof Types: Concrete roofs were most common (38%), followed by hand-made tiles (31%) and G.I./Metal/Asbestos sheets (11.4%). The prevalence of concrete roofs signifies better resilience to flood impacts compared to thatch, bamboo, or wood roofs.

5.4 Number of Rooms: A significant portion of households (52.9%) had only one room, indicating potential overcrowding issues during flood evacuation or sheltering. However, notable portions (12.4%) have three rooms or more, suggesting better-equipped households.

5.5 House Ownership: The majority of houses were owned (84%), while 12.8% were rented, and 3.2% fell under other ownership categories. Owned houses might have better maintenance and investment in flood resilience compared to rented ones.

5.6 Wall Types: Burnt brick walls were most common (63.3%), followed by grass/thatch/bamboo walls (16.1%). Burnt brick walls offer better structural integrity and flood resistance compared to natural materials like grass or bamboo. Mud/Unburnt brick walls (11.3%) are observed, which increases the severity of floods in this district.

5.7 Drinking Water Sources: Tap water from treated sources (32.2%) and hand pumps (40.1%) were the primary sources of drinking water of this district, indicating relatively good access to safe drinking water. However, reliance on untreated water sources (6.6%) poses health risks, especially during floods.

Overall, the results highlight varying degrees of vulnerability within different socio-economic indicators, emphasizing the importance of targeted interventions to enhance resilience and mitigate flood-related risks in North 24 Parganas District.

6. Conclusion:

While North 24 Parganas exhibits a mix of resilient housing infrastructure and vulnerability factors, certain aspects such as dilapidated households, reliance on untreated water sources, and suboptimal wall and roof materials highlight areas for intervention. Strategies focusing on upgrading vulnerable housing, improving water quality, and enhancing flood resilience are imperative for ensuring the well-being of the population in the face of natural disasters.

In conclusion, the quantitative assessment of socio-economic vulnerability to flood disasters in the North 24 Parganas district highlights the intricate interplay of demographic, economic, and social factors in shaping vulnerability levels. Through comprehensive data collection and rigorous analysis, this research has unveiled the nuanced dimensions of vulnerability, providing valuable insights for stakeholders. By synthesizing the findings, this study equips policymakers, disaster management authorities, and local communities with crucial information to prioritize interventions and allocate resources effectively. Targeted efforts focusing on enhancing resilience, improving infrastructure, and addressing socio-economic disparities are imperative for mitigating the impact of flood disasters and fostering sustainable development in vulnerable regions like the North 24 Parganas district.

Moving forward, interdisciplinary collaboration and community engagement will be pivotal in implementing holistic strategies that effectively reduce vulnerability to future flood events. By leveraging diverse expertise and engaging with local communities, stakeholders can develop and implement context-specific interventions that enhance resilience and promote long-term sustainability. In essence, this research underscores the importance of proactive measures and collective action in addressing socio-economic vulnerability to flood disasters. By working together and implementing evidence-based strategies, we can build more resilient communities and mitigate the adverse impacts of flooding, ultimately fostering a safer and more sustainable future for all.

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